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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/907,903 | 07/19/2001 | Kyoko Yamamoto | 2185-0554P-SP | 9946 |

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| EXAMINER | |
|---|---|
| HON, SOW FUN | |
| **ART UNIT** | **PAPER NUMBER** |
| 1772 | |

DATE MAILED: 12/29/2003

11

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 09/907,903 | YAMAMOTO ET AL. |
| | Examiner | Art Unit |
| | Sow-Fun Hon | 1772 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on 03 October 2002.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-15 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-15 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Withdrawn Rejections*

1. The 35 U.S.C. 112, 2nd paragraph rejections of claims in Paper # 8 (mailed 02/09/03) are withdrawn due to Applicant's amendment and clarifications in Paper # 10 (filed 10/03/03).

2. The 35 U.S.C. 102(b) and 103(a) rejections in Paper # 8 (mailed 02/09/03) are withdrawn due to Applicant's amendment and clarifications in Paper # 10 (filed 10/03/03).

### *New Rejections*

### *Claim Rejections – 35 USC § 102*

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-5, 7-8, 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Yoshinaga et al. (EP 0843197A2) as evidenced by NASA (Imagine the Universe! Dictionary).

Yoshinaga et al. teaches a liquid crystal device comprising a micro-porous polymer film and a substance (low molecular weight mesomorphic compound) filled in the micropores of the film, wherein the micropores are elliptical in form so that the ratio of the major axis to the minor axis of the ellipse (spheroid) is over 1, since the ratio of 1 would be that of a circle (sphere). The minor axis size of the ellipse is 0.1 to 10 microns (diameter of a shorter axis of the spheroid) (column 4, lines 55-60 and column 5, lines 1-5) and would be smaller than the wavelengths of light greater than 0.1 to 10 microns which translate into 100 to 1000 nm. This range encompasses the range of wavelengths of from about 400 to about 700 nm which is the visible part of the light spectrum as evidenced by NASA.

NASA teaches that visible light is in the wavelength range of around 400 to 700 nm (Under V section).

Yoshinaga et al. teaches that the porous film has a stretch ratio of 1.5 to 50 after uniaxial stretching (orientation in one direction) (column 5, lines 30-40), thus the ratio of the major axis to the minor axis of the oriented ellipse is 1.5 to 50. The void (volume) fraction occupied by micropores in the micro-porous polymer film is from 80 to 98 % (column 5, lines 9-15), which overlaps the upper end of the claimed range of from 30 to 85. With 80 % void fraction (porosity) (column 5, lines 9-15), which is later filled by the liquid crystal, the microporous film has gas permeability which overlaps the claimed range of from 5 to 5,000 sec/100 $cc.cm^2$.

Yoshinaga et al. teaches that the refractive index of the substance (nematic liquid crystal which has refractive index anisotropy since the ordinary and extraordinary refractive indices are not equal, $n_o$, $n_{\parallel}=1.7$ and $n_e$, $n_{\perp}=1.5$) differs from the refractive index of the microporous film ($n=1.4$) (column 24, lines 1-20) so as to function as a scattering film. The anisotropic scattering film has scattering anisotropy to a polarized component of a polarized light due to the ordinary and extraordinary refractive indices not being equal (column 24, lines 15-20).

### *Claim Rejections - 35 USC § 103*

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshinaga et al. in view of Hirai et al.

Yoshinaga et al. has been discussed above, and teaches the liquid crystal display with the anisotropic scattering sheet, but fails to teach that the refractive index of the polymer, n, and the extraordinary refractive index $n_e$ and ordinary index $n_o$ of the liquid crystal should be such that $0.01 < |n - n_e| > 0.6$ and $0 \leq |n - n_o| < 0.05$.

Hirai et al. teaches a liquid crystal panel (display element) comprising an anisotropic scattering sheet (liquid crystal polymer composite material) combined with a backlight and a mirror or a diffusion plate (column 4, lines 35-55). Hirai et al. teaches that the value of the refractive index anisotropy liquid crystal should be large, $|n_e - n_o| > 0.22$ ($\Delta n$), in order to obtain high scattering property values (column 8, lines 25-35). The ordinary refractive index $n_o$ of the liquid crystal should agree with the refractive index of the polymer matrix n ($n_p$) in order to obtain high transmittance when an electric field is applied, that is, $|n_o - n| = |n - n_o| < 0.03$ when $n_o - 0.03 < n$ is rearranged (column 8, lines 25-40). When $n = n_o$, then $|n_e - n_o| = |n_e - n| = |n - n_e| > 0.22$.

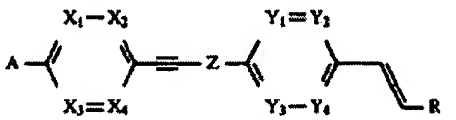
As shown above, Hirai et al. teaches that $|n - n_o| <0.03$ for high scattering in the absence of an electric field and $|n - n_e| > 0.22$ for high transmittance upon application of an electric field (column 8, lines 25-35). Thus it would have been obvious to one of ordinary skill in the art to have used the criteria of Hirai et al. to govern the refractive indices of n, $n_e$ and $n_o$ of the anisotropic scattering sheet of Yoshinaga et al. in order to obtain the desired high scattering in the absence of an electric field, and high transmittance in the presence of an electric field.

7. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshinaga et al. in view of Tsubata et al.

Yoshinaga et al. has been discussed above, and teaches the liquid crystal display with the anisotropic scattering sheet, but fails to teach that the liquid crystal is polymerizable, or that it includes the claimed acetylene connected 1,4-phenylene unit formulae.

Tsubata et al. teaches a liquid crystal mixture having a large anisotropy of refractive index and a polymer dispersed liquid crystal device comprising the same (column 1, lines 5-15).

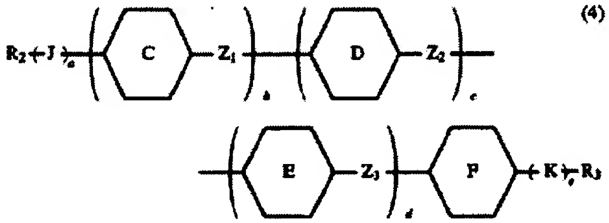
A liquid crystal mixture containing (a) at least one compound of a compound of the formula (1):



(1)

in which R is a $C_1$–$C_{12}$ alkyl group, etc.; $X_1$, $X_2$, $X_3$, $X_4$, $Y_1$, $Y_2$, $Y_3$ and $Y_4$ represent, independently each other, CH, CF or N; A is a hydrogen atom, a 4-$R_1$-(cycloalkyl) group, etc. in which Ris a $C_1$–$C_{12}$ alkyl group, etc. and p is 0 or 1; and Z is —C≡C— or a single bond, and (b) at least one compound of the formula (4):

(4)



wherein rings C, D, E and F represent, independently each other, 1,4-phenylene, etc. which may be substituted by 1, 2 or 3 fluorine atoms; $R_2$ is a hydrogen atom, a $C_1$–$C_{12}$ alkyl group, etc.; $R_3$ is a hydrogen atom, a fluorine atom, a fluoromethyl group, etc.; $Z_1$, $Z_2$ and $Z_3$ represent, independently each other, —COO—, —OCO—, —$OCH_2$—, —$CH_2O$—, a $C_1$–$C_5$ alkylene group, a $C_2$–$C_5$ alkenylene group, etc.; J and K represent, independently each other, a methylene group or —O—; a, b, c, d and e represent, independently each other, 0 or 1.

As seen above, Tsubata et al. teaches that the liquid crystal in the polymer dispersed liquid crystal has formulae overlapping the range of formulae claimed by Applicant, comprising the 1,4-phenylene units connected by the acetylene connector ≡, also known as the $C_2$ alkenylene group. The double bond in the terminal group R is polymerizable.

Tsubata et al. shows that the anisotropy of the refractive index of the liquid crystalline compounds is large compared to liquid crystalline compounds with non acetylene connected 1,4 biphenylene units (column 2, lines 25-35 and column 37, lines 1-11). Thus it would have been obvious to one of ordinary skill in the art to have used the liquid crystals with the acetylene connected 1,4 biphenylene units and polymerizable end group of Tsubata et al. as the liquid crystal compound in the anisotropic scattering sheet of Yoshinaga et al. in order to obtain the desired high scattering.

8. Claims 6, 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson in view of Yoshinaga et al., as evidenced by NASA (Imagine the Universe! Dictionary).

Larson has a liquid crystal display which comprises a liquid crystal display panel having a polarizing plate on the front surface side and the back surface side (front 15 and rear 16 polarizers), the anisotropic scattering sheet (PSSE 17), a light guide (light source 13 and light guide 102 or 112) and a diffuse reflection plate (diffusely reflecting cavity 11) in that order (column 4, lines 25-35 and column 9, lines 60-70). A retardation plate (retarder108) is located between the anisotropic scattering sheet (PSSE 109) and the reflection plate (reflector mirror 105) (column 10, lines 5-15). The transmission axis of the anisotropic scattering film and the transmission axis of a polarizing plate on the back surface side of the liquid crystal panel are approximately equal (PSSE transmits the majority of the light polarized along one optical axis (column 4, lines 45-55) so that since it has comparable axis of symmetry with a parallel-aligned absorbing polarizer (column 5, lines 40-50), the transmission axes are comparably parallel).

Larson teaches that the anisotropic scattering sheet (PSSE) is a uniaxial aligned liquid crystal filled microporous polymer film (PDLC structure) where the liquid crystal droplets are elongated (into ellipses), oriented along one direction (stretched along axis 23) and the refractive indices of the liquid crystal are selected such that the ordinary index of the liquid crystal matches the corresponding refractive index of the polymer, and the other index (extraordinary) is highly mismatched (column 6, lines 20-40). The liquid crystal substance is polymerized (UV curable LC, polymeric LC) (column 8, lines 1-5).

When the liquid crystal droplets are stretched (column 6, lines 20-40) they form ellipses which have a major and a minor axis whereby the ratio of the major axis to the minor axis is over 1. See Fig. 3a below wherein the major axis of the ellipse 22 is parallel to the stretch direction of polymer matrix 21.

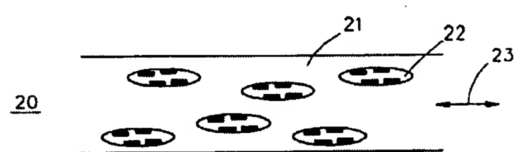


Fig. 3a

Larson fails to disclose the void fraction of the anisotropic scattering sheet, or that the minor axis size of the stretched micropores is smaller than the wavelength of light in a visible light region.

Yoshinaga et al. teaches a liquid crystal device comprising a micro-porous polymer film and a substance (low molecular weight mesomorphic compound) filled in the micropores of the film, wherein the micropores are elliptical in form so that the ratio of the major axis to the minor axis of the ellipse (spheroid) is over 1, since the ratio of 1 would be that of a circle (sphere). The minor axis size of the ellipse is 0.1 to 10 microns (diameter of a shorter axis of the spheroid)

(column 4, lines 55-60 and column 5, lines 1-5) and would be smaller than the wavelengths of light greater than 0.1 to 10 microns which translate into 100 to 1000 nm. This range encompasses the range of wavelengths of from about 400 to about 700 nm which is the visible part of the light spectrum as evidenced by NASA.

NASA teaches that visible light is in the wavelength range of around 400 to 700 nm (Under V section).

Yoshinaga et al. thus provides evidence that the dimension of the minor axis of the micropores being smaller than a wavelength of light in a visible light region is within the scope of the invention of Larson.

Yoshinaga et al. teaches that the porous film has a stretch ratio of 1.5 to 50 after uniaxial stretching (orientation in one direction) (column 5, lines 30-40), thus the ratio of the major axis to the minor axis of the oriented ellipse is 1.5 to 50. The void (volume) fraction occupied by micropores in the micro-porous polymer film is from 80 to 98 % (column 5, lines 9-15), which overlaps the upper end of the claimed range of from 30 to 85 %. With 80 % void fraction (porosity) (column 5, lines 9-15), which is later filled by the liquid crystal, the microporous film has gas permeability which overlaps the claimed range of from 5 to 5,000 sec/100 cc.cm$^2$.

Yoshinaga et al. thus provides evidence that a porosity in the claimed range of from 30 to 85 % in the absence of the liquid crystal material for the light scattering sheet of Larson is within the realm of the invention.

***Response to Arguments***

9. Applicant's arguments with respect to claims 1-15 have been considered but are moot in view of the new ground(s) of rejection. However, Applicant's arguments directed to the valid application of the pertinent prior art are addressed below in order to advance prosecution.

10. Applicant argues that the anisotropic film in the present application is used as it is without switching of applied voltage while transmission and scattering of incident light into the porous film of Yoshinaga et al. is controlled by switching applied voltage.

Applicant is respectfully apprised that Yoshinaga et al. does teach that without applied voltage (removed), the liquid crystal (mesomorphic compound) reverts to its original scattering state due to the orientation imparted by the oriented film (column 6, lines 15-30). Hence the film does function as a scattering sheet in the absence of applied voltage.

11. Applicant argues that the porous film of Yoshinaga et al. needs a higher porosity of 80-98% because it requires ON-OFF of applied voltage in order to change the orientation of filling substances in the pores.

Applicant is respectfully apprised that the upper limit of the claimed porosity range of from 30 to 85 % in the present application overlaps with the lower limit of the 80 to 98 % range of Yoshinaga et al.

12. Applicant argues that Yoshinaga et al. teaches that a large range of pore diameter can be used and any shapes of pores can be used, but does not teach specifically the minor axis size of ellipse form less than the wavelength of light.

Applicant is respectfully apprised that Yoshinaga et al. does teach that the minor axis size of the ellipse is 0.1 to 10 microns (diameter of a shorter axis of the spheroid) (column 4, lines 55-

60 and column 5, lines 1-5) and would be smaller than the wavelengths of light greater than 0.1 to 10 microns, which translate into 100 to 1000 nm. This range encompasses the range of wavelengths of from about 400 to about 800 nm for the term “visible light region” as defined by Applicant in Paper # 10 (filed 10/03/03).

### *Conclusion*

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number is (703)308-3265 or (571)272-1492 after December 29, 2003.. The examiner can normally be reached Monday to Friday from 9:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached on (703)308-4251 or (571)272-1498 after December 29, 2003. The fax phone number for the organization where this application or proceeding is assigned is (703)872-9311.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

SH
Sow-Fun Hon
12/22/03

HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772
12/23/03